Return on IOOS Investments

The global component of IOOS

The benefits of global scale observations are clear. Studies on improved El Niño Southern Oscillation (ENSO) forecasts show:

- Farmers in the U.S. could increase agricultural output and produce benefits to the economy of $275-300 million per year by using seasonal forecasts to guide planting decisions.
- Using ENSO forecasts just for corn storage decisions could produce benefits as high as $200 million.
- Information on seasonal precipitation will improve electricity production. In the largest Tennessee Valley Authority reservoirs, winter stream flows in El Niño years can be 30 percent above normal, allowing efficiency gains by switching from thermal to hydropower.

The coastal component of IOOS

Obtaining and integrating ocean observations is most critical in the coastal zone, where the impacts of human activities are most acute. Coastal counties account for 19% of U.S. land area, yet these counties contain 38% of the population, 37% of housing and over 42% of the total economy.

An integrated ocean observing system (IOOS) will benefit everyone whose livelihood is linked to the nation's coast. Once deployed, the system will produce:

- Short term environmental data, helping the public plan recreational activities and improving search and rescue efforts.
- Medium to long term environmental data, increasing the accuracy of ship routing information and supporting extraction of offshore resources.
- Environmental information, improving the management of fisheries and the coastal zone, water quality, beaches and public health.
- Climate variability information, improving seasonal forecasts of rainfall, storm surge, hurricane probability, and long-term temperature trends.
- Long-term ocean climate data, improving estimates of atmospheric climate change, sea level changes, and changes in sea ice limits.

Significant progress has been made in developing a European Global Ocean Observing System . The estimated minimum value added to the EU GNP by a prediction system is about $1.4-2.3 B per year. Investments in IOOS should provide comparable benefits to the U.S. economy. Gulf of Maine Ocean Observing System is a regional effort designed to bring hourly oceanographic data from the Gulf of Maine to all who need it. An economic analysis of GoMOOS shows a 5 to 1 ratio of potential annual benefits to cost.

Recent studies on market requirements for a coastal IOOS suggest:

- Better preparation, response, and mitigation will reduce average costs (~$500M per event) of storm-related disasters by 10% (~$50M per event) = ~14 events X $50M = $700M savings per year.
- Hurricanes and other severe weather events impact energy production. Improved storm track and landfall forecasts could prevent unnecessary evacuations and potentially save off-shore companies as much as 3 days of production shut-down, at an estimated savings of $15M per day.
- Improved forecasts of hurricanes and other major storms would save the U.S. Navy great amounts of money by preventing unnecessary moving of the fleet.
- Adverse weather delays cost Great Lakes shipping companies nearly $10,000 per hour.

- The $60B coastal recreation and tourism economy is directly dependent upon understanding and forecasting environmental conditions.
- At least half of all commercial ocean transits today use weather-based vessel routing services, saving on the order of $300M in transportation costs annually. Increases in future water-borne trade traffic, accompanied by improvements in weather and oceanographic observations should lead to even greater returns on investment.

The coastal component of IOOS will extend the application and value of several key NOAA business lines. For instance, new levels of accuracy in 'storm track' forecast capability were used for Hurricane Isabel. By integrating large scale observations and models with more fine grained regional observations, we were able to make a notable improvement in the forecasts of 'impacts of coastal storms.' These forecasts will provide targeted evacuation notices and reduce costs associated with extreme events in the nation's most populated areas.

NOAA Contributions to the Development of Coastal IOOS

IOOS is developing in two related and interdependent modules:

- The global ocean module, concerned primarily with detecting and predicting basin scale variability, extreme weather, and global climate change. The Argos deployment supports about 40% of the requirements endorsed by GCOOS.
- The coastal module, concerned primarily with managing and mitigating the effects of these phenomena and human activities on the Nation's socio-economic systems, its estuaries and the EEZ. Development of the coastal module in the US began recently in coordination with the larger scale ocean module and the emerging earth observing system (EOS).

NOAA is leading the development of the coastal component of the IOOS by:

- Building the infrastructure and capabilities to support implementation of the coastal component. NOAA and Navy provide primary support for Ocean.US.
- Delivering products through the web (building on NOAA's leadership in OMB Geospatial One Stop), dial-in (exploiting NOAA's PORTS architecture), and satellite data communications.
- NOAA is working with NOAA- and ONR-funded coastal observing systems to develop 'single portal' delivery of key parameters. A 'live' demonstration is being planned for the February NORLC meeting.
- Building the national backbone though investments in:
  - doubling the national baseline and regional networks of NWLON measurements and NDBC buoys, utilizing sentinel sites such as NERRs and NSF LTERs
  - enhancing future capabilities within all regions by obtaining physical oceanographic sensors (buoys and tide gauges) and meteorological sensors (tide gauges);
  - establishing the Regional Associations that will coordinate increased density of observations and variables measured and processed based on priorities established by user groups.

(As a specific example of the benefits of integration of existing observational elements: during the past year, NDBC has increased observational throughput by 21% by integrating existing non-federal observation onto the GTS and other feeds to use for weather analyses and forecasts)

The development of regional observing systems nested in a national backbone of observations and data management is fundamental to linking user requirements to the provision of IOOS data on global, national, regional, and local scales. Immediate priorities for developing regional observing systems that use data and information provided by the global ocean-climate component are:

- Establish and sustain Regional Associations (RAs) that allow users and providers to participate in the development and output of regional observing systems; and

- Build the Coastal Observation Technology System (in coordination with other NOAA/ONR funded efforts) to conduct the coordinated research required to create infrastructure and develop methods for collecting, sharing, and integrating data .

Attainment of the IOOS vision depends upon a data management infrastructure that joins IOOS partners (government agencies, private enterprises, and academia) into a seamless data sharing framework on local to global scales. Improved data management infrastructure is critical to the success of the IOOS. Under the leadership of the Ocean.US office, a Data Management and Communications (DMAC) Steering Committee has produced an implementation plan with 10 year budget requirements. Additionally, a surface current mapping initiative is being developed by Ocean.US that will establish a coastal network of HR radar (the coastal equivalent of the Argo pilot project). Enthusiastic users for these data span the spectrum from shipping and fishing industries to public agencies concerned with public health and environmental protection.

NOPP's Ocean.US enterprise is driving the planning and development for the coastal component of IOOS just as NOAA's Office of Climate Observations is leading the development of the global component of the US contribution. Through investments in data, research and pilot projects and in the shepherding of maturing regional systems through pre-operational and into an operational mode, NOAA is playing a significant role in establishing the integrated ocean observing system. NOAA is expected to drive IOOS towards an operational observing system and assume its leadership. The benefits to NOAA are greater ability to work with other agencies and organizations to fulfill mission objectives more effectively, contribute substantially to the 'ocean contribution' to the GNP, and demonstrate a new, more collaborative mode of working with others to leverage observational investments across the board on local, regional and national scales to benefit the nation.